REMARKS

Claims 1-18 are pending in this application, with Claims 1, 4, 5 and 12 being independent.

Claims 1-7, 10, 12-14 and 17 were rejected under 35 U.S.C. § 103(a) as allegedly obvious over Shirota et al. (U.S. Patent No. 5,792,249) in view of Osumi et al. (U.S. Patent No. 6,280,513). Claims 8, 9, 15 and 16 were rejected under 35 U.S.C. § 103(a) as allegedly obvious over the same two references and further in view of Matzinger (U.S. Patent No. 6,020,397). Claims 11 and 18 were rejected under 35 U.S.C. § 103(a) as allegedly obvious over the same two references and further in view of Koyano et al. (JP 2002-079739). Applicants respectfully disagree with these rejections.

Before addressing the merits of the rejections, Applicants believe it will be helpful to review some features and advantages of the present invention. The present invention, as recited in Claim 1, relates to a reaction solution for use in image recording with an ink containing a coloring material in a dissolved or dispersed state. The reaction solution, in contact with the ink, destabilizes the dissolved or dispersed state of the coloring material in the ink. The reaction solution contains at least a polyvalent metal ion and a nonionic polymer. The Ka value of the reaction solution according to the Bristow method is from 1.3 $mL \cdot m^{-2} \cdot msec^{-1/2}$ to 3.0 $mL \cdot^{-2} \cdot msec^{-1/2}$, inclusive. The viscosity of the reaction solution is from 20 mPa·s to 150 mPa·s, inclusive.

Claim 4 relates to a set of an ink and a reaction solution of comparable scope. Claim 5 relates to an ink jet recording apparatus comprising a recording head for discharging an ink and means for supplying a reaction solution of comparable scope. Claim 12 relates to an

image recording method comprising the steps of coating a recording medium with a reaction solution of comparable scope, and coating the ink on the recording medium by an ink jet method.

The present invention seeks to solve the technical problem that when a reaction solution containing a polyvalent metal ion and a nonionic polymer is applied to normal paper by roller coating, the resultant images tend to have an uneven image density. (See the specification at page 3, line 7 to page 4, line 20.) Applicants submit that a person of skill in the art would have tried to solve this problem by reducing the penetration of the reaction solution into the paper, in order to enhance contact between the ink and the reaction solution for sufficient reaction between the coloring material and the reaction solution. Applicants, however, solved the problem by means of the above-noted features of the present invention.

The Examples and Comparative Examples demonstrate the importance of the various features recited in the present invention. Specifically, reaction solutions having a smaller Ka value (1.2 $mL \cdot m^{-2} \cdot msec^{-1/2}$ in Comparative Example 1 and 1.1 $mL \cdot^{-2} \cdot msec^{-1/2}$ in Comparative Example 2), a larger Ka value (3.1 $mL \cdot^{-2} \cdot msec^{-1/2}$ in Comparative Example 6), a smaller viscosity (12 mPa·s in Comparative Example 3 and 19 mPa·s in Comparative Example 5), or a larger viscosity (156 mPa·s in Comparative Example 4) than what is recited in Claim 1 did not achieve the advantages of the present invention. See Tables 1 and 2 at pages 44 and 47 of the specification. Applicants submit that this shows the criticality of the ranges of the values recited in the present invention.

In Applicants' view, the cited references do not teach or suggest the claimed invention. Shirota et al. discloses a liquid composition (reaction solution), but does not mention the Ka value of the reaction solution, as noted by the Examiner. Various organic solvents are

merely listed as examples of solvents that may be used (col. 6, lines 14-30). Applicants note that reaction solutions prepared in the Examples do not contain solvents or surfactants that provide penetrability to the reaction solution. Applicants therefore conclude that a person of skill in the art would presume that the Ka values of these reaction solutions are lower than the range defined in Claims 1, 4, 5 and 12 of the present invention.

Furthermore, although Shirota et al. recites the roller method as one of the methods for applying the reaction solution to the entire surface of the recording medium, selective application with the ink-jet method is preferred (col. 7, lines 49-62). In Applicants' view, this disclosure demonstrates that Shirota et al. does not address or even recognize the technical problem solved by the present invention. On the contrary, Shirota et al. is seen as advocating the above-mentioned approach that lower penetrability of the reaction solution is preferable. Shirota et al. is not seen to teach or suggest the technical idea of the present invention that the physical properties of the reaction solution are defined to be in a very narrow range in order to use a reaction solution of relatively high viscosity efficiently.

Osumi et al. is cited for its teaching that the Ka value of the ink is not more than 1.5. Applicants note that this means that a higher optical density is obtained by suppressing ink penetration as much as possible, and that this technique is contrary to that of the present invention, in which penetration of the reaction solution, to a certain extent, is intended. Moreover, the Ka values of 1.2 and 1.1 in Comparative Examples 1 and 2 of the present invention fall within the preferred range of Osumi et al., but the beneficial effect of the present invention is not obtained with them.

Accordingly, Osumi et al.'s teaching regarding Ka does not provide the claimed Ka feature of the present invention, which is also missing from Shirota et al.

The Examiner takes the position that the present invention is obvious over Shirota et al. in view of Osumi et al. on the grounds that Shirota et al. teaches that the physical properties of the liquid composition and of the ink are almost the same, while Osumi et al. discloses an ink having a Ka value of not more than 1.5. Thus, a person skilled in the art would have to modify the Shirota et al. liquid composition to have a Ka value of not more than 1.5. Applicants submit that this step would not be obvious, since Shirota et al. does not disclose Ka value at all. Rather, Shirota et al. intends to use the ink-jet method for application of the reaction solution, which Applicants see as inconsistent with the technical idea of the present invention.

Applicants further submit that neither Matzinger (which is cited for its teaching regarding pH of the reaction solution being lower than that of the ink and regarding viscosity of the reaction solution being greater than that of the ink) nor Koyano et al. (which is cited for its teaching regarding coating amount) remedy the deficiencies of the Shirota et al./Osumi et al. combination.

Applicants conclude that the cited references do not teach or suggest the claimed invention, either singly or in the combinations proposed by the Examiner, assuming such combination is proper. Applicants therefore respectfully request that the Section 103 rejections be withdrawn.

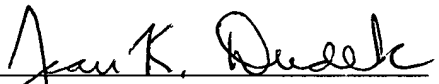
Applicants submit that the present invention is patentably defined by independent Claims 1, 4, 5 and 12 for the reasons discussed above. The dependent claims are also submitted to be patentable for the same reasons as their respective independent claims and for the

patentable features set forth therein. Individual consideration of each dependent claim is requested.

Applicants request favorable reconsideration, withdrawal of all rejections and passage to issue of the above-identified application.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,



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